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W. M. CHAPMAN.

REPEATER.

No. 575,025. Patented Jan. 12, 1897.

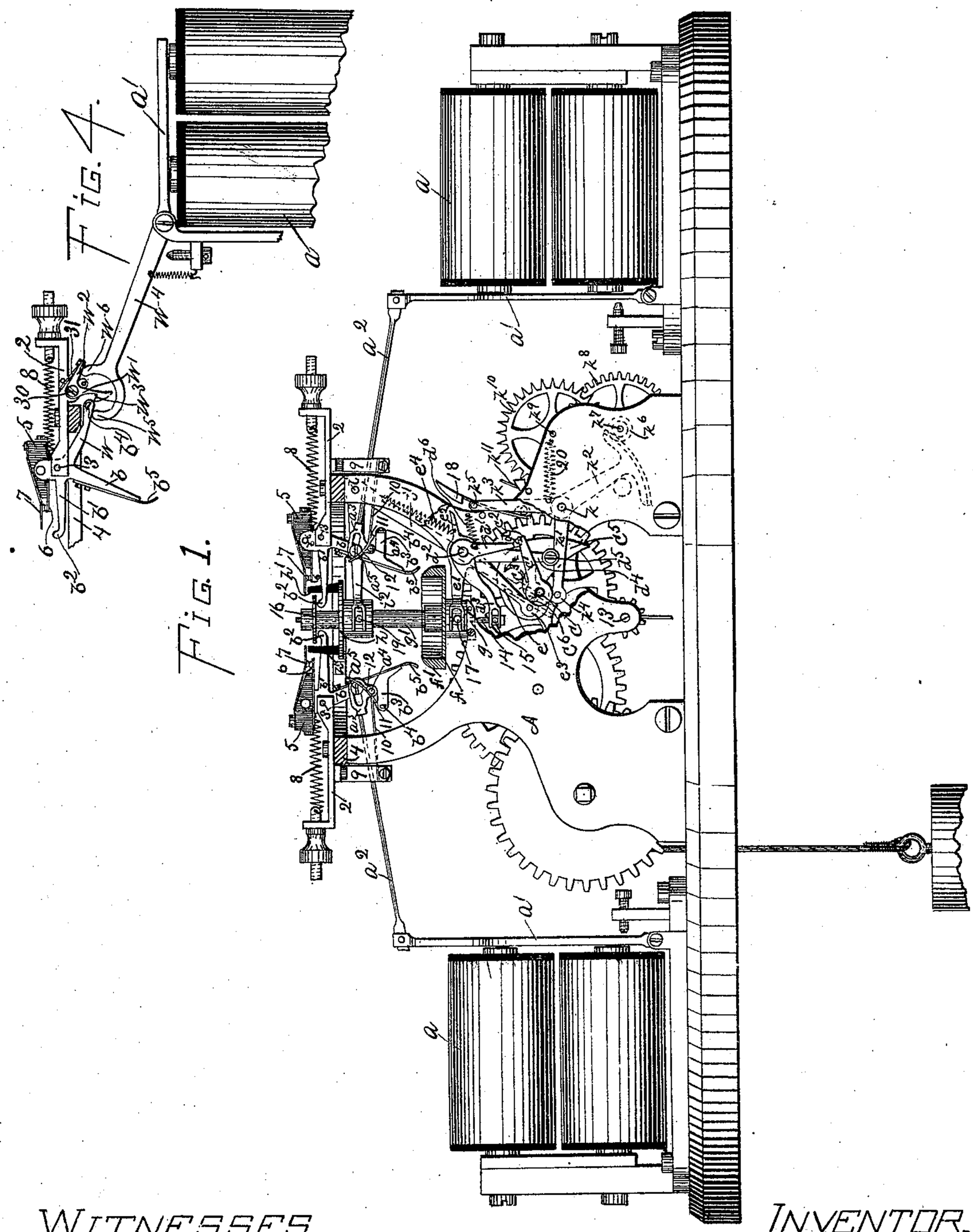

FIG. 1.

FIG. 4.

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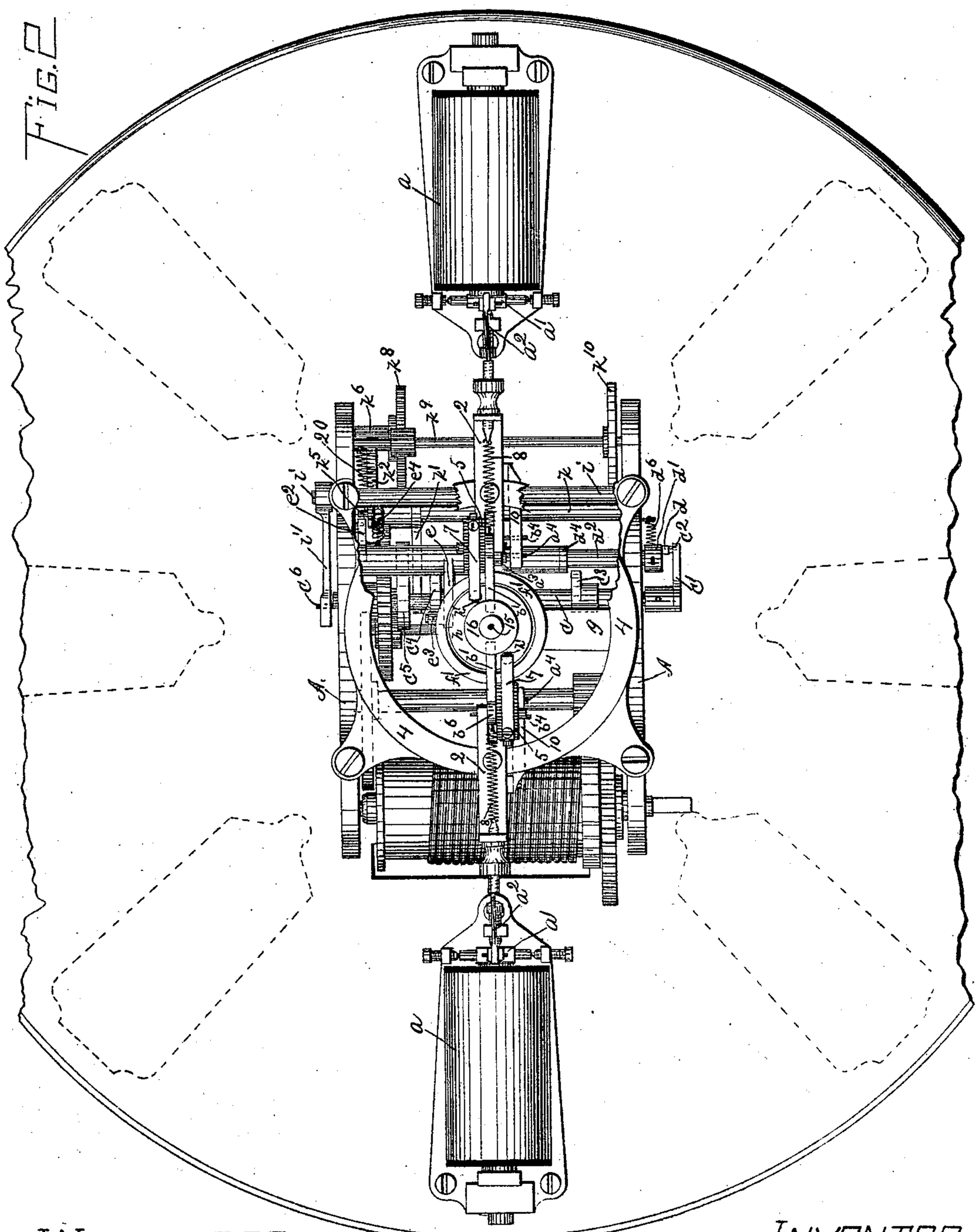
FIG. 2



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REPEATER.

No. 575,025. Patented Jan. 12, 1897.

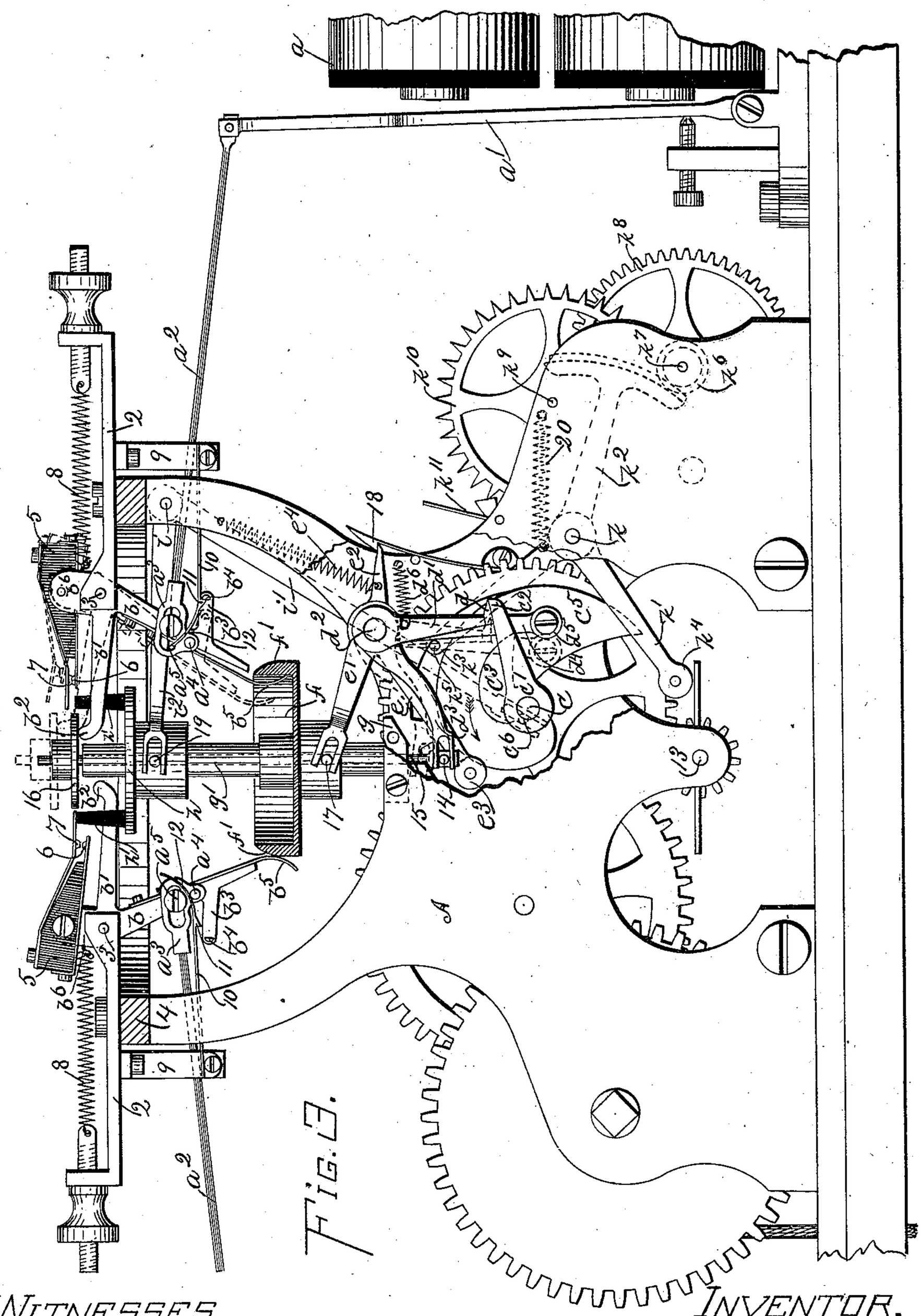

Fig. 3.

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REPEATER.

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FIG. 5.

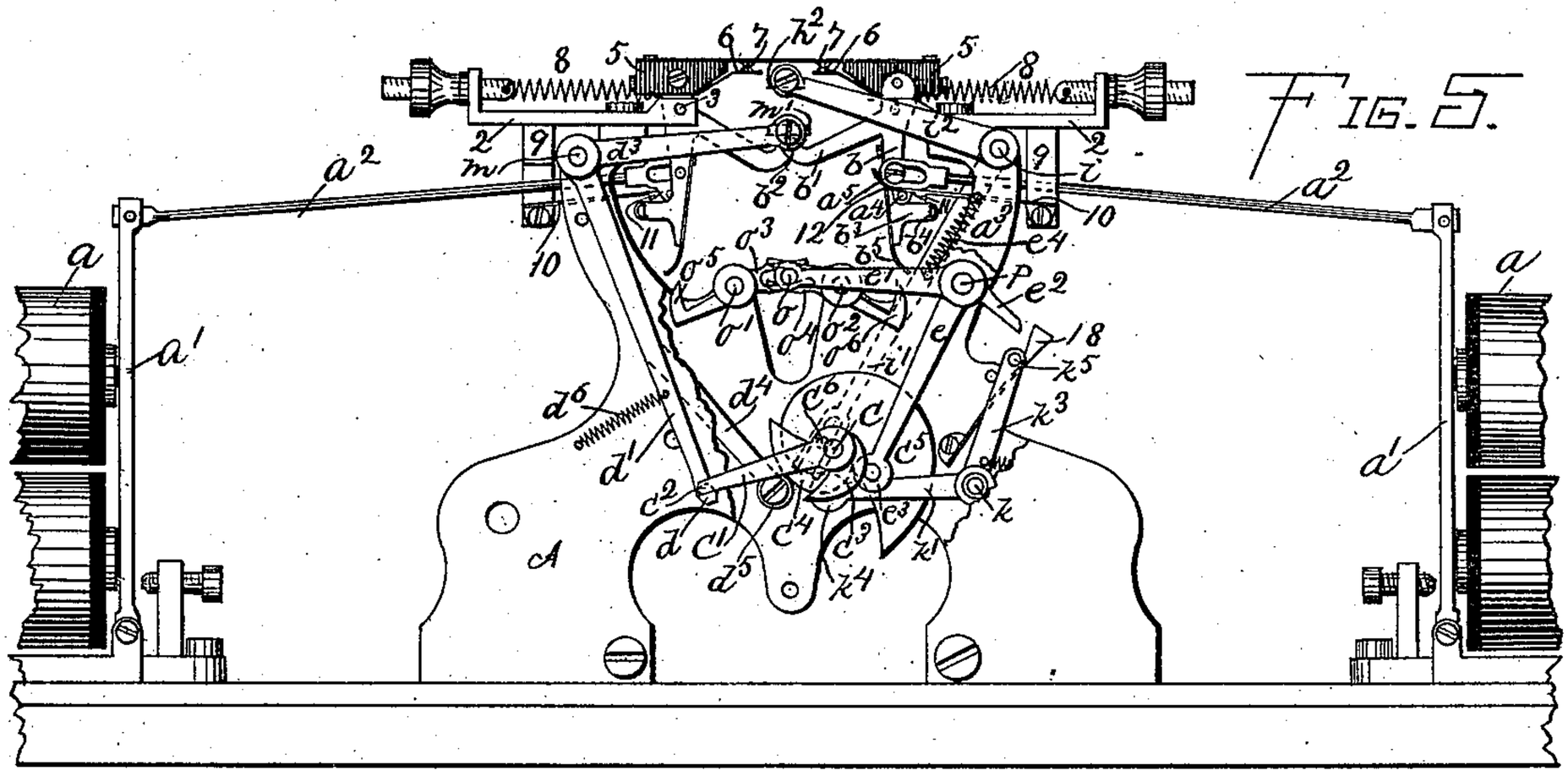
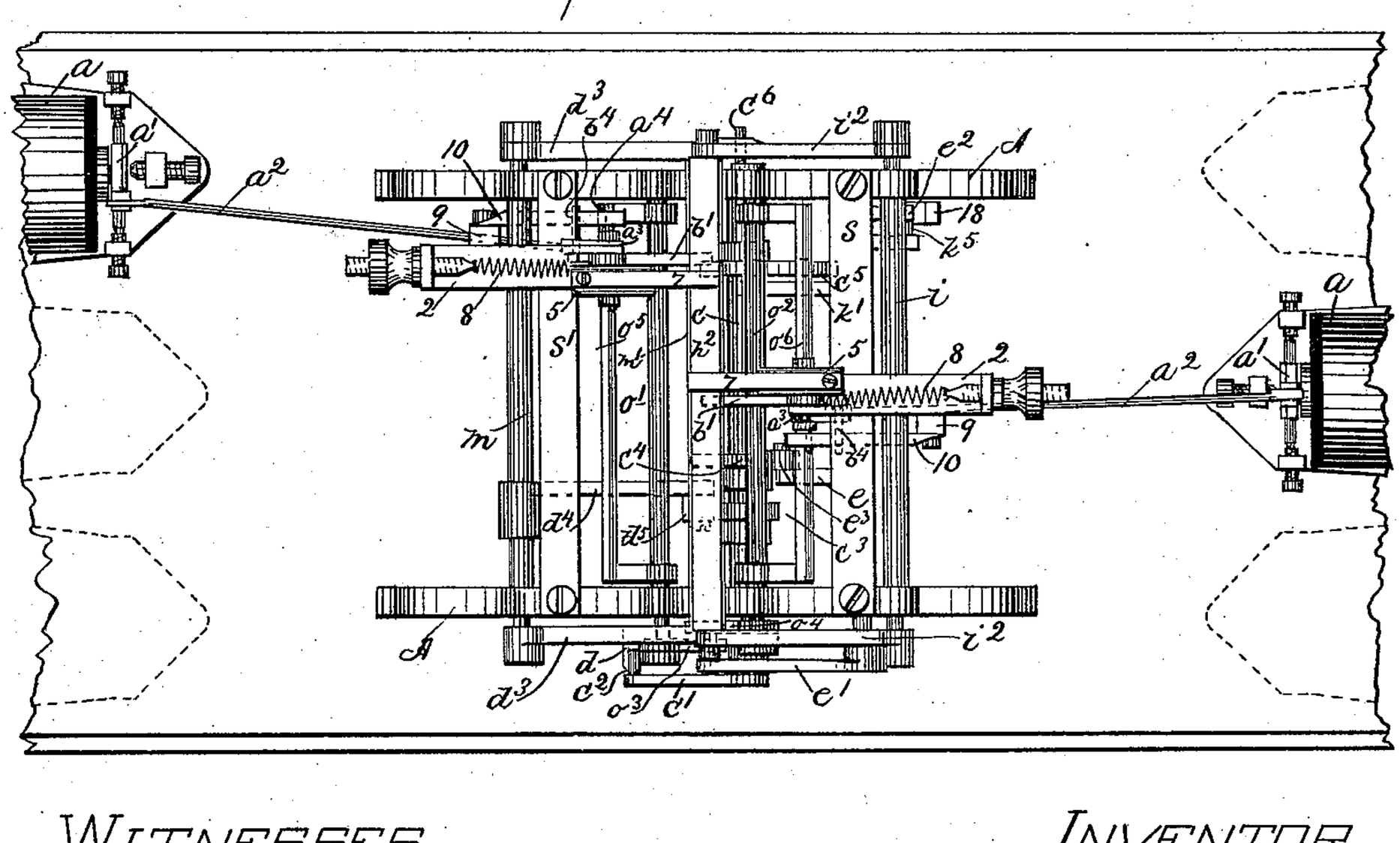


FIG. 6.



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UNITED STATES PATENT OFFICE.

WINTHROP M. CHAPMAN, OF NEEDHAM, MASSACHUSETTS.

REPEATER.

SPECIFICATION forming part of Letters Patent No. 575,025, dated January 12, 1897.

Application filed December 12, 1895. Serial No. 571,892. (No model.)

To all whom it may concern:

Be it known that I, WINTHROP M. CHAPMAN, of Needham, county of Norfolk, State of Massachusetts, have invented an Improvement in Repeaters, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention relates to electric signaling apparatus, and is embodied in a machine commonly known as a "non-interfering repeater," and is especially adapted for use in connection with fire-alarm systems.

The object of a repeater is to so connect two or more independent electric circuits that a signal sent over any one of them may be transmitted or repeated over all the remaining circuits.

This repeater is so arranged that while signals sent over any circuit may be repeated over the remaining circuits, yet each circuit is complete by itself, and should any circuit connected with the repeater become disabled or inoperative at any time through breaking of the line or otherwise the remaining circuits will not be affected, and as soon as the disabled circuit is repaired it is again brought into operative condition.

The repeater is also provided with a non-interfering device or locking-out mechanism which is adapted when a signal is being sent over one circuit to prevent any other signal which might be sent over any other circuit from interfering with the action of the repeater until after the completion of the signal then being transmitted.

It is also necessary that the repeater be so arranged that when an impulse is sent on any circuit it will not react on that circuit.

These above-mentioned results are accomplished in the repeater herein described, briefly, as follows: Each circuit is provided at the repeater with an electromagnet or controller and parts operated by it and a repeating circuit-closer. The above-mentioned controller and circuit-closers are connected directly in the circuit, and as fire-alarm systems as generally constructed are operated on a closed circuit these circuit-closers are normally closed. When the first break occurs on any circuit, the controller in that circuit becomes demagnetized, thus allowing the parts operated by it to be moved to release the main train or motor of the repeater. The first action of the motor after being released is to operate the locking-out mechanism into such a position as to prevent any other circuit than the one first operating from acting on the repeater. The movement of this locking-out device is herein arranged to also move the repeating circuit-closers of all the circuits but the operating-circuit into such a position that they may be acted upon and operated by the main motor. As the repeating circuit-closers of the different circuits are opened an impulse corresponding to the break in the operating-circuit is repeated or transmitted over the several circuits.

The parts operated by the controller of the operating-circuit being in their retracted position when the above-mentioned locking-out device is moved they are left free to operate, and the repeating circuit-closer of said circuit is not in position to be operated on. This prevents the repeater from reacting on the operating-circuit.

During the last part of each movement or operation of the main motor of the repeater, or just before it comes to rest at the end of each impulse, said main motor positively restores the parts operated by the controllers to their normal positions, where they are held by suitable means provided until they are released by the action of the armature, when it is again attracted. This action of the machine in restoring said operating parts serves to relieve the controller from performing this work, and therefore said controller has only to hold the parts after they have been restored. Another result which is attained by this mechanical restoration of the operating parts is that in case of a circuit being disabled (as, for instance, by a broken line) this action would restore the operating parts until they were caught by a catch or other suitable means provided. This catch would then hold the parts in such a position that they would not interfere with the working of the rest of the machine, and whenever the damage to the circuit was repaired they would resume their normal positions.

The locking-out device before referred to, having been moved into its locking-out posi-

tion by the first action of the main motor of the repeater, is held in said position until a predetermined time after the completion of a signal, when it is released and allowed to assume its normal position by means of a timing-train wound up by the main motor.

As has been hereinbefore stated, the action of the parts operated by the controliers of the operating-circuit in retracting releases the mechanism of the main train or motor, so that when these parts are restored by the action of said motor the detent of said motor is also restored to its locking position, so that each time the motor has completed the operations above enumerated it will be brought to rest by said detent.

The herein-described repeater is so constructed that circuits may be added to or taken away from it without in the least interfering with the rest of the machine. To secure this result, all of the parts operated by the controllers are arranged on independent supports secured to the main frame, so that when it is desired to add another circuit it is merely necessary to add another independent support to a suitable portion of the frame of the machine provided for that purpose and to secure a suitable controller to the base of the machine for the new circuit.

As herein shown, the repeater is constructed on a circular base, the main mechanism being placed in the center and the circuits arranged around it; but I do not wish to limit myself to this particular construction, as it might be made in several different ways and yet accomplish substantially the same results as herein accomplished and in substantially the same way.

Figure 1 shows in side elevation and partial section a repeater embodying this invention, two circuits only being shown for clearness. Fig. 2 is a plan view of the mechanism shown in Fig. 1. Fig. 3 is an enlarged view of the mechanism shown in Fig. 1, the parts being in the position that they will occupy as the main motor comes to rest after the first impulse of the signal has been received and repeated. Figs. 4, 5, and 6 are modifications to be referred to.

Each circuit connected with the repeater has an electromagnet or controller a, responsive to changes therein, and to the armature a' of said electromagnet one end of a rod a^2 is loosely attached by means of a pin, the other end of said rod being secured to a connecting piece or block a^3, from one side of which a pin a^4 projects.

The connecting-piece a^3 is formed with an elongated slot which receives a screw or stud a^5, projecting laterally from one arm b of a bell-crank lever, pivoted at 3 to an independent support 2, thereby forming a loose connection or joint between the armature and said bell-crank lever. The other arm b' of said bell-crank lever is provided at its extremity with a projection b^2, or said arm may be simply upturned at the end. The arm b' of said bell-crank lever normally occupies substantially a horizontal position and serves as the operating device or lever for the repeater, and the arm b extends downwardly at a more or less oblique angle and forms a coöperative part of the locking-out mechanism. The arm b of the bell-crank lever has a projection b^3, from which laterally projects a pin b^4.

Fastened to the inner face or edge of the arm b is a flat spring b^5, which extends downwardly a short distance, projecting below or beyond the end of the arm to which it is attached, and the portion thereof which projects beyond the end of said arm is curved outwardly or away from the center.

An ear b^6 is formed on or integral with the bell-crank lever b b', projecting above the pivot 3 thereof, and a block 5 of insulating material, as hard rubber, is rigidly secured to said ear, said block 5 supporting or carrying the contact-springs 6 and 7, which together form a circuit-closing device, and as this device is employed to operate the circuit to repeat the signal it is herein called the "repeating circuit-closing device." To said ear b^6 is also attached one end of a spiral retraction-spring 8, the other end of said spring being attached to a suitable adjusting-screw, having its bearings in the independent support 2.

On a suitable projection 9, secured to the under side of the independent support 2 a flat spring 10 is fastened. This spring 10 is provided with a catch 11 and a curved portion 12, said catch coöperating with the pin b^4 on the arm b^3, and said curved portion being acted upon by the pin a^4 on the connecting-piece a^3, which latter thus forms a releasing device for the catch.

The above-described parts comprise the essential working parts for a circuit, and a separate set or group is provided for each circuit connected with the repeater.

The main frame A of the repeater consists, essentially, of two side plates, and to the top of said plates a ring 4 is secured, and the independent supports 2 for the operating parts above described for each circuit are secured to said ring 4. These independent supports 2 may be removed and replaced easily, and additional ones provided, without deranging the working parts of the repeater.

The main train or motor of the repeater consists of the large train of wheels shown on the left side of the drawings. This train may be driven either by a spring or weight, but is here shown as driven by a weight, and it is adapted to rotate the shaft c in the direction shown by the arrow in Figs. 1 and 3 when the said motor is released. The motion of this train is regulated by a fan on the shaft 13.

Secured to the shaft c is a detent or arm c', having a projection c^2, which is adapted normally to engage with a projection d on an arm d' and thereby lock the trainwork of the main motor. This arm d' is secured to a shaft d^2,

which is adapted to be rocked by means to be described to remove said arm from its engagement with the detent c^2 to release the train or main motor. There are also secured to the shaft c three cams c^3, c^4, and c^5, and on one end of the said shaft c an eccentric-pin c^6 is formed. (See dotted lines, Figs. 1 and 3.) Besides the arm d' there are also secured to the rock-shaft d^2 two arms d^3 and d^4.

The arm d^3 terminates in a forked end, which embraces or receives a pin 14, projecting from the lower end of a vertical rod 15, thereby connecting said rod 15 with said shaft d^2, and to the upper end of said rod 15 a disk 16 is secured, beneath which terminate all the operating devices or arms b'. As any one of said operating devices b' is raised, as it will be by the retraction of the armature of one of the electromagnets, said disk is engaged and lifted, raising the rod 15, and by means of the arm d^3, connected therewith, the shaft d^2 is rocked to thereby release the main motor. The rod 15 is contained within and is free to slide vertically in a quill g', which is erected stationarily upon a horizontal plate g, attached to the frame. The arm d^4, which is secured to said rock-shaft d^2, has a roll d^5, which is so placed as to lie in the path of movement of and to be acted upon by the cam c^3.

Fastened to the arm d' is one end of a light spiral spring d^6, the other end of which is secured to a suitable portion of the frame. This spring d^6 serves merely to hold the arm d' in such a position that the projection d may be retained in a position to engage the detent and lock the train of the main motor.

Loosely mounted on the shaft d^2 is a hub, from which project three arms e, e', and e^2. The arm e is provided with a roll e^3, arranged to occupy a suitable position or to lie in the path of movement of and be acted upon by the cam c^4, which is secured to the shaft c. This cam c^4 is of the same size and shape as the cam c^3 and is disposed on the shaft c the same as said cam c^3, so that it does not appear in Figs. 1 and 3, and when said shaft c revolves for its first time the cam c^4 engages the roll e^3 on the arm e and moves it and also the arms e' e^2.

The arm e' terminates in a forked end, which is connected with a flanged wheel or collar f by means of a pin 17, which projects from the hub of said flanged wheel f and is embraced by the forked end of said arm, and as the arm e is moved by the cam c^4 the arm e' is correspondingly moved, raising the flanged wheel f.

The arm e^2 is adapted to engage a spring-catch 18 when depressed, as it will be when the arm e is moved by the cam c^4, and to at such time hold the flanged wheel f in its elevated position, as shown in Fig. 3. The catch 18 will thus hold the flanged wheel until it is disengaged from the arm e^2 after the end of the signal. One end of a spiral spring e^4 is attached to the arm e^2, the other end of said spring being secured to the frame of the repeater. The object of this spring e^4 is to return the flanged wheel f and its attached parts to their normal positions, as shown in Fig. 1, when the catch 18 has disengaged the arm e^2.

The flanged wheel f is arranged to slide freely on the quill g', being thus moved thereon by the arm e'. The outside portion of the flange of the wheel f is curved, as at f'.

The flanged wheel f normally lies just below the projecting springs b^5 on the arms b and in such relation thereto that whenever said flanged wheel is raised said springs b^5 will bear externally upon the flange unless the arm bearing the spring has been moved inward, in which case said spring b^5 will enter or pass within the flange.

The arms b of the bell-crank levers b b' and attached springs b^5 or equivalents, the flanged wheel f, and means for raising it and holding it in elevated position constitute the locking-out mechanism for the operating devices or levers, and as will be seen locks all of said operating devices except the one connected with the controller of the operating-circuit, the spring b^5 on the arm b of that particular device terminating within the flange, and thereby permitting certain freedom of action to that particular operating device. The flanged wheel f has also another function in addition to locking the operating devices—viz., to bring the repeating circuit-closers of all the circuits except the operating-circuit in operative position, as will be described.

Besides the main motor or train the only other motor or train employed in the repeater is a small train of wheels having their bearings in the main frame of the machine on the right-hand side. This train serves as a timing device for the locking-out mechanism. To the first shaft k of this governing or timing train are secured the arms k', k^2, and k^3. The arm k' is provided with a roll k^4, which lies in the path of movement of and is acted upon by the cam c^5 on the shaft c, and when so acted upon the three arms k', k^2, and k^3 are moved into the position shown in Fig. 3, thereby winding up the timing-train, as will be described. After being thus wound the timing-train is gradually restored to its normal position by the action of the spring 20.

Projecting laterally from the end of the arm k^3 is a pin k^5, which is arranged so that as the timing-train runs down or resumes its normal position it will strike the spring-catch 18 and disengage it from the arm e^2 and thereby allow the spring e^4 to restore the flanged wheel f from its elevated to its normal or depressed condition.

On the end of the arm k^2 are formed teeth which mesh with the teeth of a pinion k^6, having secured to it a ratchet-wheel, which allows said pinion to revolve freely on the shaft k^7 when the cam c^5 winds up the timing-train; but when the spring 20 moves the parts in the opposite direction a pawl secured

to the shaft k^7 engages with the teeth of the above-mentioned ratchet-wheel and thus causes the shaft k^7, and consequently the rest of the timing-train, to operate.

On the shaft k^7 is secured the wheel k^8, which engages with a suitable pinion secured to the shaft k^9. To this shaft k^9 is also secured the escape-wheel k^{10}, which engages with a suitable pallet secured to the same shaft as the fan k^{11}. Thus it will be seen that the flanged wheel is elevated upon the reception of the first impulse of a signal and is locked in its elevated position by the catch 18, which is only disengaged after the timing device has been permitted to resume its normal position at the end of a signal.

A disk h is arranged on a suitable hub which is adapted to slide freely on the quill g' and is provided with plugs or uprights h', there being as many plugs as there are circuits connected with the repeater. These plugs or uprights h' are made of insulating material and are set in the disk h directly beneath the ends of the contact-springs 7 of the repeating circuit-closers.

A shaft i is pivotally supported in the framework at the upper right-hand side of the machine, and secured to it are the arms i' and i^2, forming in conjunction with the shaft a bell-crank lever. The arm i' is provided with a forked end which engages with or embraces the eccentric-pin c^6 on the shaft c. The arm i^2 also terminates in a forked end, which is connected with the disk h by means of a pin 19, secured to and projecting from the hub of said disk h.

Each time the shaft c revolves its eccentric-pin c^6 operates the bell-crank lever i' i^2 and moves the disk h, causing the plugs h' thereon to operate the repeating circuit-closers.

The operation of the repeater is as follows, and to make the explanation clearer let it be understood that the parts shown on right of drawings are in the operating-circuit of the repeater or circuit which is being operated by some distant signal-box and that the parts shown on the left of drawings are in the circuit over which the signal received from the operating-circuit is being repeated or transmitted through the repeater: When the first break occurs on any circuit, the controller a in that circuit becomes demagnetized, thus allowing the retraction-spring 8 to retract the armature a' and attached parts and also to swing the bell-crank lever b b' on its pivot 3 into the position indicated by dotted lines, Fig. 3. During the time this bell-crank lever b b' is thus moved by the action of the spring 8 the pin a^4 on the connecting-piece a^3 engages with the curved portion 12 of the spring 10, thus keeping the catch 11 out of the path of engagement of the pin b^4. As the above-mentioned bell-crank lever swings the curved end b^5 of the spring on the arm b passes over the top of the flange f', and the projection b^2 on the arm b' engages with and raises the disk 16, in turn raising the rod 15, and by means of the arm d^3, connected therewith, rocking the shaft d^2, and as the arms d' and d^4 are also secured to said shaft d^2 they will consequently be moved toward the left as said shaft d^2 is thus rocked. (See dotted lines, Fig. 3.) As the arm d' is thus moved toward the left the projection d thereon disengages the projection c^2 on the detent c', thus releasing the main train or motor of the repeater. As the motor is thus released the shaft c, with its attached parts, begins to revolve in the direction of the arrow. During the first half of the revolution of said shaft c the eccentric-pin c^6, operating on the forked end of the arm i' of the bell-crank lever i' i^2, pivoted at i, depresses the other arm i^2 of said bell-crank lever, and the latter being connected, by means of the pin 19, to the hub of the disk h, carrying the plugs or uprights h', said disk will also be depressed. At the same time that the above-mentioned operations have been taking place, that is, during a little less than the first half of the revolution of the shaft c, the cam c^4 acts upon the roll e^3 on the arm e, thereby moving the arms e, e', and e^2 into the positions shown in Fig. 3 and elevating said flanged wheel f also as therein shown. As these parts are moved into the above-mentioned position the spring-catch 18 engages the arm e^2 and thereby holds said parts in their abnormal positions until after the completion of the whole signal or alarm or until said catch 18 is disengaged from the arm e^2. As the flanged wheel f is thus raised the curved exterior portion f' of its flange acts on the curved portions of the springs b^5 of all the depending arms b of the bell-crank levers b b' except that one connected with the operating device of the operating-circuit. This action of the curved portion f' of the flange serves to swing the repeating circuit-closers of all but the operating-circuit bodily on their pivots 3 in a direction toward the plugs h', but as said plugs h' are being depressed at this time the latter do not engage or act upon the contact-springs 7 of said circuit-closers. Also, as will be seen by reference to Fig. 3, while the circuit first operating has moved its spring b^5 into position to enter the flange, and is thus free to operate the repeater, the remaining circuits have the curved portions of their springs b^5 bearing on the outside of said flange f', and the operating-arms b' are thus held securely from operating the repeater. During the last half of the revolution of the shaft c the eccentric-pin c^6 on said shaft c, operating on the forked end of the arm i', causes the disk h, carrying the plugs h', to ascend, thus bringing said plugs h' into engagement with the ends of the contact-springs 7. As the plugs h' are thus brought into engagement with the ends of said contact-springs 7 they lift said springs 7 out of engagement with the springs 6, thus operating the circuit-closers, and thereby causing a break or impulse to be transmitted over all the circuits except the operating-cir-

cuit. (See Fig. 3.) Before the shaft c has completed its revolution the cam c^3, acting on the roll d^5 on the arm d^4, moves the arms d', d^3, and d^4 and the parts connected with them back nearly to their normal positions, as shown in full lines, Fig. 3. This brings the arms d' into such a position that the projection d thereon is in the path of engagement of the projection c^2 on the detent c', so that when the shaft c completes its revolution the projection c^2 strikes the projection d and arrests the main motor. As the arm d^3 is thus moved by the action of the cam c^4 the bell-crank lever $b\ b'$ of the operating-circuit, pivoted at 3, is also moved against the action of its retraction-spring 8 (by means of the connecting-rod 15 and the disk 16, which latter acts upon the projection b^2) until the pin b^4 engages with the catch 11 on the spring 10. This serves the double purpose of removing from the magnet the work of restoring the operating parts against the action of the tension-spring 8 during the ordinary operation of the repeater, and also of holding the operating parts of a broken or disabled circuit in such a position by means of the catch 11 engaging with the pin b^4 that they will not interfere with the action of the rest of the repeater. As the magnet a is again magnetized it has merely to draw up its armature a', the rod a^2, and the connecting-piece a^3, the elongated slot in said connecting-piece a^3 permitting free motion of these parts. Just before the armature a' comes to rest in its attracted position the pin a^4 in the connecting-piece a^3 strikes the curved portion 12 of the spring 10 and raises the catch 11 out of engagement with the pin b^4, and when said armature comes to rest has moved the operating parts of the operating-circuit just a little farther against the action of the spring 8.

While the above-mentioned operations have been going on, *i. e.*, while the shaft c has been making one complete revolution, the cam c^5 on said shaft has been acting on the roll k^4 on the arm k' during almost the whole of the revolution of the shaft and has moved the arms k', k^2, and k^3 into the positions shown in Fig. 3. This action of the cam c^5 winds up the timing-train and also removes the pin k^5 on the arm k^3 from the spring-catch 18, thus allowing the said catch 18 to assume a position to engage with the arm e^2 as said arm is moved into locking position.

The subsequent impulses of a signal have substantially the same effect on the mechanism of the repeater as the first impulse heretofore described, with the exception that the cam c^4 does not act on the roll e^3, as it and the parts connected with it and operated on by said cam c^4 are, after the first impulse, held in their abnormal positions by the catch 18.

As has been heretofore said this repeater is designed particularly for use in fire-alarm systems. Such systems are so arranged that between the separate impulses of any signal there are certain predetermined periods of time, and the timing-train of the repeater is so adjusted that it requires a longer time for it to run down after having been wound up by the action of the cam c^5 than the longest time between the impulses of a signal.

After the last impulse of a signal has been sent as the time-train assumes its normal or run-down position by the action of the spring 20 the pin k^5 on the arm k^3 is moved in engagement with the spring-catch 18, thereby disengaging it from the arm e^2. As the catch 18 is thus removed from engagement with the arm e^2 the spring e^4 restores the arms e, e', and e^2 and also the flanged wheel f to their normal positions, as shown in Fig. 1, and the repeater is then in its normal condition and ready to receive and repeat another signal.

Instead of employing a connecting-link between the armatures and the bell-crank levers, as shown in Figs. 1, 2, and 3, I may use the construction shown in Fig. 4, wherein the bell-crank lever $b\ b'$ has a projecting arm w, bearing the pin b^4.

A small bell-crank lever $w'\ w^2$ is pivoted at 30 to the under side of the independent support 2. On the arm w' of this bell-crank lever a catch w^3 is formed, and a flat spring 31 is secured at one end of the arm w^2, the other end of said spring 31 engaging a suitable pin extending laterally from the independent support 2. This bell-crank lever $w'\ w^2$ takes the place of or corresponds to the spring 10 in Figs. 1, 2, and 3, the catch w^3 corresponds to the catch 11, and the arm w^2 corresponds to the curved portion 12 of spring 10.

The electromagnet is placed vertically, and its armature a' has an arm w^4 secured to or formed integral with it, which is provided at its extremity with two projections $w^5\ w^6$.

The projection w^5 is adapted to engage the end of the arm w when the armature is attracted and thereby hold the bell-crank lever $b\ b'$.

The projection w^6 is adapted to engage the arm w^2 of the bell-crank lever $w'\ w^2$, and thereby hold the catch w^3 out of the path of engagement of the pin b^4 on the arm w when the armature is attracted.

In Figs. 5 and 6 a modification of the arrangement of the repeater is shown, the circuits being placed in rows at either side or end of the main mechanism of the repeater instead of in a circular form around it, as shown in Figs. 1, 2, and 3. As in the said figures, only two circuits are here shown for clearness. In this modification the independent supports 2 for the operating parts of the circuits are secured to supporting-pieces $s\ s'$, which are secured to the top part of the frame A A, these supports $s\ s'$ taking the place of the ring 4 in the other figures.

In Figs. 5 and 6 the arms b' of the bell-crank levers, pivoted at 3, terminate under a flat strip of metal m', which extends across from one side of the machine to the other and takes the place of the disk 16 in Figs. 1, 2, and 3. This strip m' is secured at either end

to the end of one of the arms d^3, which in turn are secured to the rock-shaft m, to which is also secured the locking-arm d' and the arm d^4, which carries the roll d^5. It will be seen that the connecting-rod 15 in Figs. 1, 2, and 3 is thus dispensed with. In this modification a strip h^2 of insulating material extends across the machine directly under the ends of the contact-springs 7 of the circuit-closers. This strip h^2 is secured at either end to one of the arms i^2 on the shaft i and takes the place of the disk h and plugs h' in Figs. 1, 2, and 3.

In the original Figs. 1, 2, and 3 the locking-out device is shown as a flanged wheel f, arranged to be moved into or out of locking-out position by sliding on the quill g'.

In the modification the parts that take the place of the said flanged wheel f consist of arms secured to the shafts o' and o^2, said arms terminating in upturned portions o^5 and o^6, which extend nearly from one side of the main motor-frame to the other. These upturned portions o^5 and o^6 fulfil the same functions as the flange f' in Figs. 1, 2, and 3. Secured also respectively to the shafts o' and o^2 are the arms o^3 and o^4, and these arms terminate in forked ends which embrace the pin o, which is secured in and extends laterally from the arm e'. This arm e' is attached to the shaft p, as are also the arms e and e^2. As the shaft c revolves the cam c^4 acts on the roll e^3 on the arm e, thereby swinging the arm e' downward.

As has been heretofore stated, the arms o^3 and o^4 are secured, respectively, to the shafts o' and o^2, and as the arms carrying the locking-out upturned portions o^5 and o^6 are also respectively secured to the same shafts it will be seen that as the arm e' is depressed the pin o, engaging the forked ends of the arms o^3 and o^4, causes the upturned locking-out portions o^5 and o^6 to be swung into their elevated or locking-out position. As the arm e' is depressed the arm e^2 is elevated, and as the parts o^5 and o^6 assume their elevated position they are held there by the arm e^2, engaging the catch 18.

I claim—

1. In a repeater, the combination of two or more circuits each having a controller, independent operating devices for the repeater corresponding in number to the number of circuits and operated respectively by the said controllers, a repeating circuit-closer for each circuit, and independent detachable supports attached to the main frame of the repeater, each bearing one of the operating devices and also one of the repeating circuit-closers, substantially as described.

2. In a repeater, the combination of two or more circuits each having a controller, operating devices for the repeater, corresponding in number to the number of circuits and operated respectively by the controllers, locking-out mechanism for holding all of said operating devices except the one connected with the operating-circuit, a coöperative part of said locking-out mechanism being connected with the operating devices, and an independent detachable support attached to the main frame for each operating device and parts connected therewith, substantially as described.

3. In a repeater, the combination of two or more circuits each having a controller, operating devices for the repeater, corresponding in number to the number of circuits and operated respectively by the controllers, locking-out mechanism for holding all of said operating devices except the one connected with the operating-circuit, a repeating circuit-closer for each circuit, connected to and movable with a coöperative part of the locking-out mechanism said locking-out mechanism being formed integral with the operating devices, and an independent support attached to the main frame for each operating device and parts rigidly connected therewith, substantially as described.

4. In a repeater, the combination of two or more circuits each having a controller, bell-crank levers b, b', corresponding in number to the number of circuits and operated respectively by said controllers, a repeating circuit-closer for each circuit rigidly attached to its corresponding bell-crank lever, and independent supports attached to the main frame, each bearing one of the bell-crank levers, and attached repeating circuit-closers, substantially as described.

5. In a repeater, the combination of a main motor, two or more circuits each having a controller independently-movable operating devices for the main motor corresponding in number to the number of circuits, and operated respectively by said controllers, locking-out mechanism for holding all of said operating devices except the one connected with the operating-circuit from operating the main motor, a coöperative part of said locking-out mechanism being rigidly secured to or formed integral with its corresponding operating device, and a repeating circuit-closer for each circuit also rigidly secured to said operating device, substantially as described.

6. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices for the main motor operated by said controllers, and restoring mechanism for said operating devices operated by said main motor at the end of each impulse of the signal, said operating devices being adapted to engage a projection common to them all, said projection being connected to an arm secured to a shaft, said shaft having also secured to it the locking-arm for the main motor, and also another arm carrying a roll, said roll being arranged to be acted on by a cam operated by the main motor, said operating devices serving to release said main motor, and said cam acting to restore said operating devices, and said operating devices also being

so constructed that they may be restored by their controllers or magnets independent of said main motor, substantially as described.

7. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices for the main motor operated by said controllers, and restoring mechanism for said operating devices operated by said main motor at the end of each impulse of a signal, said restoring mechanism serving to partially restore said operating devices, and a latch for holding the operating device in its partially-restored position, and a releasing device for said latch operated by the controller, said action of the controller also serving to complete the restoration of said operating parts, substantially as described.

8. In a repeater, the combination of a main motor, two or more circuits each having a controller, and a corresponding number of operating devices for the main motor operated by said controllers, a locking-lever for said main motor having a single locking-surface, and operated by any one of said operating devices to release said main motor, and a restoring mechanism for said locking-lever operated by the main motor at the end of each impulse of the signal, said locking-lever also being so arranged that it may be restored by the action of the controllers independent of the action of said main motor, substantially as described.

9. In a repeater, the combination of a main motor, two or more circuits each having a controller, and a corresponding number of operating devices for the main motor operated by said controllers, a locking-lever for said main motor having a single locking-surface, and operated by any one of said operating devices, and a restoring mechanism for said locking-lever operated by the main motor at the end of each impulse of the signal, said locking-lever and said operating devices being so constructed that they may also be restored by their controllers or magnets independent of the restoring mechanism of said main motor, and a latch for holding the locking-lever in its restored position when restored by the main motor, and a releasing device for said latch operated by the controller, said latch not being operative when said locking-lever is restored by the controllers, substantially as described.

10. In a repeater, the combination of a main motor, two or more circuits each having a controller, and a corresponding number of operating devices for the main motor operated by said controllers, restoring mechanism for said operating devices operated by said main motor at each impulse of a signal, and a locking-lever for said main motor operated by any one of the operating devices to release the motor and restored by said restoring mechanism, said operating devices being so constructed that they may also be restored by their controllers independent of the action of said main motor, such action of said controllers also allowing said locking-lever to assume its locking position, substantially as described.

11. In a repeater, the combination of a main motor, two or more circuits each having a controller, and a corresponding number of operating devices for the main motor, operated by said controllers, restoring mechanism for said operating devices operated by said main motor at the end of each impulse of a signal, and a locking-lever for said main motor operated by any one of the operating devices to release the motor and restored by said restoring mechanism, said operating devices and said locking-levers being so constructed that they may be restored by their controllers or magnets independent of the action of said main motor and a latch for holding the operating device and locking-lever in their restored positions when restored by the action of the main motor, said latch not being operative when said parts are restored by their controllers, and a releasing device for said latch operated by the controller, substantially as described.

12. In a repeater, two or more circuits each having a controller, independent operating-levers corresponding in number to the number of circuits and operated respectively by said controllers, a main motor, a vertically-movable rod common to all said operating-levers and adapted to be acted upon and moved by any one of them to mechanically release said main motor, a pivoted locking-lever for said main motor and an intermediate connection between said vertically-movable rod and said locking-lever, substantially as described.

13. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices, operated respectively by said controllers to repeatedly release the main motor, a repeating circuit-closer for each circuit, both members of which are secured to an independently-movable base, a device for operating said repeating circuit-closers actuated directly by said main motor, and means directly operated by said main motor for moving bodily both members of all of said repeating circuit-closers except the one connected with the operating-circuit, into the path of movement of and so as to be operated by said device, substantially as described.

14. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices, operated respectively by said controllers to repeatedly release the main motor, a repeating circuit-closer for each circuit, both members of which are secured to an independently-movable base, a device for operating said repeating circuit-closers actuated directly by said main motor, and means directly operated by said main motor for moving bodily both members of all of said repeating circuit-closers except the one connected

with the operating-circuit, into the path of movement of and so as to be operated by said device, and for holding them in such position until after the completion of the signal, substantially as described.

15. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices operated respectively by said controllers to repeatedly release the main motor, a repeating circuit-closer for each circuit, both members of which are secured to an independently-movable base, a device for operating said repeating circuit-closers actuated directly by said main motor, a locking-out mechanism for the operating devices positively moved into locking-out position by the main motor, a latch for holding the locking-out mechanism in such position, a releasing-arm therefor, and a timing device controlled by the main motor for operating said releasing-arm, substantially as described.

16. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices operated respectively by said controllers to repeatedly release the main motor, a repeating circuit-closer for each circuit, both members of which are secured to an independently-movable base, a device for operating said repeating circuit-closers actuated directly by said main motor, a locking-out mechanism for the operating devices, positively moved into locking-out position by the main motor, said locking-out mechanism also moving bodily both members of all the repeating circuit-closers except the one connected with the operating-circuit into the path of movement of and so as to be operated by the main motor, substantially as described.

17. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating devices operated respectively by said controllers to repeatedly release the main motor, a repeating circuit-closer for each circuit, both members of which are secured to an independently-movable base, a device for operating said repeating circuit-closers actuated directly by said main motor, a locking-out mechanism for the operating devices, positively moved into locking-out position by the main motor, said locking-out mechanism also moving bodily both members of all the repeating circuit-closers except the one connected with the operating-circuit into the path of movement of and so as to be operated by the main motor, a latch for holding said locking-out mechanism in its locking position, a releasing-arm therefor, and a timing device controlled by the main motor for operating said releasing-arm to move the latch at the completion of a signal, substantially as described.

18. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of bell-crank levers b, b', operated respectively by said controllers, the arms b' thereof serving as operating-levers and the arms b depending therefrom, and a flanged wheel f moved by said main motor upon the reception of the first impulse into position to engage and hold all of said arms b thereby positively holding them all except the one connected with the operating-lever of the operating-circuit from operating the repeater, substantially as described.

19. In a repeater, the combination of a main motor, two or more circuits each having a controller, a corresponding number of operating-levers operated respectively by said controllers, a repeating circuit-closer for each circuit rigidly secured to its corresponding operating-lever, a pivoted support therefor, a device for operating said circuit-closers to repeat the signal actuated directly by the main motor, arms depending from the support of said repeating circuit-closers, and a flanged wheel f adapted to engage all of said arms except the one connected with the repeating circuit-closer of the operating-circuit, and to thereby bodily move said repeating circuit-closers into the path of movement of their operating devices, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WINTHROP M. CHAPMAN.

Witnesses:
B. J. NOYES,
F. H. DAVIS.